

1. A process to polymerize olefins comprising contacting olefins with a catalyst system comprising an activator and a catalyst precursor represented by the formula:



**Cp** is a substituted or unsubstituted cycloalkadienyl group or related cycloalkadienyl cogener,

each **Q** is independently an anionic leaving group,

**J** is a group 15, 16 or ~~17~~ atom;

$a$  is the oxidation state of D,

**D** is a group 4, 5, or 6 metal, provided however that when Cp is a mono-cyclic cyclopentadienyl group M is not titanium, and

**Y** is a heteroatom, a substituted heteroatom or a C<sub>1</sub> to C<sub>100</sub> hydrocarbyl group which may optionally contain one or more heteroatoms.

- Sudo  $\alpha$   
S  $\alpha$

9. The process of claim 1 wherein Y is a substituted or unsubstituted group 13-17 heteroatom or a C<sub>1</sub> to C<sub>40</sub> alkyl, alknyl, aryl, or arylalkyl group.

10. The process of claim 1 wherein Y is an alkyl group, a perfluoroalkyl group, a cycloalkyl group or an aryl group.

11. The process of claim 1 wherein Y is selected from the group consisting of n-propyl, isopropyl, n-butyl, t-butyl, methylcyclohexyl, methylcyclopentyl, methoxymethyl, ethoxymethyl, aminomethyl, aminoethyl, perfluoropropyl, and perfluorobutyl, cyclopentyl, cyclohexyl, bicyclo[2.2.1]heptyl, phenyl, methyl phenyl, di methyl phenyl, di n-butylphenyl, di-t-butylphenyl, mesityl, 4-trimethylsilyl, fluorophenyl, perfluorophenyl, methoxyphenyl, dimethylaminophenyl, naphthyl, and anthracenyl.

12. The process of claim 1 wherein J is nitrogen, oxygen, sulfur, phosphorus, chlorine, fluorine or bromine,

13. The process of claim 1 wherein J is oxygen, nitrogen or sulfur.

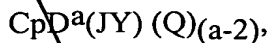
14. The process of claim 1 wherein J is oxygen.

15. The process of claim 1 wherein Cp is an indenyl group, J is oxygen and Y is a substituted or unsubstituted phenyl group.

16. The process of claim 1 wherein the process occurs in the gas phase.

17. The process of claim 1 wherein the process occurs in the slurry phase.

18. A composition comprising an activator and a catalyst precursor represented by the formula:



wherein:

**Cp** is a substituted or unsubstituted cycloalkadienyl group or related cycloalkadienyl cogener,

each **Q** is independently an anionic leaving group,

**J** is a group 15, 16 or 17 atom;

**a** is the oxidation state of **D**,

**D** is a group 4, 5 or 6 metal, provided however that when **Cp** is a mono-cyclic cyclopentadienyl group **M** is not titanium, and

**Y** is a heteroatom, a substituted heteroatom or a  $C_1$  to  $C_{100}$  hydrocarbyl group which may optionally contain one or more heteroatoms.

19. The composition of claim 18 wherein **Cp** is a cyclopentadienyl group.

20. The composition of claim 18 wherein **Cp** is an indenyl or fluorenyl group.

21. The composition of claim 18 wherein **Cp** is substituted.

22. The composition of claim 20 wherein the indene or fluorene is substituted.

23. The composition of claim 18 wherein **D** is a group four metal.

24. The composition of claim 18 wherein **D** is zirconium or hafnium.

25. The composition of claim 19 wherein **D** is zirconium.

26. The composition of claim 18 wherein **Y** is a substituted or unsubstituted group 13-17 heteroatom or a  $C_1$  to  $C_{40}$  alkyl, alknyl, aryl, or arylalkyl group.

27. The composition of claim 19 wherein **Y** is an alkyl group, a perfluoroalkyl group, a cycloalkyl group or an aryl group.

Sub  
A4  
CMT

005100-99298600

Sub B5

Sub B6

28. The composition of claim 19 wherein Y is selected from the group consisting of n-propyl, isopropyl, n-butyl, t-butyl, methylcyclohexyl, methylcyclopentyl, methoxymethyl, ethoxymethyl, aminomethyl, aminoethyl, perfluoropropyl, and perfluorobutyl, cyclopentyl, cyclohexyl, bicyclo[2.2.1]heptyl, phenyl, methyl phenyl, dimethyl phenyl, di n-butylphenyl, di-t-butylphenyl, mesityl, 4-trimethylsilyl, fluorophenyl, perfluorophenyl, methoxyphenyl, dimethylaminophenyl, naphthyl, and anthracenyl.

29. The composition of claim 18 wherein J is nitrogen, oxygen, sulfur, phosphorus, chlorine, fluorine or bromine,

30. The composition of claim 18 wherein J is oxygen, nitrogen or sulfur.

31. The composition of claim 18 wherein J is oxygen.

32. The composition of claim 18 wherein Cp is an indenyl group, J is oxygen and Y is a substituted or unsubstituted phenyl group.

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